Nome: _____ Nº

Época Especial

Métodos de Desenvolvimento de Software
2016/2017
27 June 2017
13h00
Departamento de Informática
Universidade Nova de Lisboa
(duration 2h00)

NOTE: This test should be answered in this questions booklet and is mainly composed by multiple choice questions and open box questions. Both the multiple choice and open questions should be answered in this group of sheets (no extra sheets should be added by the student).
To select wrong answers will impact negatively in the mark of the corresponding question. On multiple choice you have to select just one answer, if wrong, it will discount in the overall grade 1/3 of the value of the correct answer.

It is not allowed to remove the staple.

If the answer sheets/booklet are not identified with a name and student number it automatically will not be considered for evaluation.

The solution can be marked using pencil or pen.

You can withdraw 45 minutes after starting the test. In a case of withdrawal, please write and sign this cover page with a statement such as: "I declare that I give up", by this informing the teacher about your decision.

After 2h00 from starting the test the teachers will collect all the answer sheets.

Rules

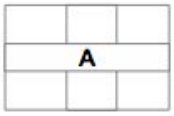
- **Duration of 2h**.
- **You can not exit during the test.**
- Can only enter during the first 30 minutes.
- Must stay 45 minutes even if intended to quit.
- No device allowed.
- Fraud attempt means to fail the course.
- Do not forget to identify with name and number your test.
- can use pencil and pen.
- Do not unstaple.
- Answer giving your best interpretation.
- Visually confusing answers will not be corrected.

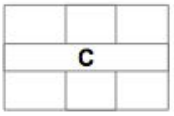
Part I - Project Management (2 points)

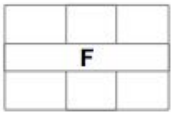
1. The table below defines the activities within a small project.

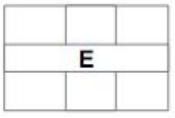
Activity	Completion time (weeks)	Immediate predecessor activities
A	2	-
B	3	-
C	4	A
D	3	B,A
E	8	D,C
F	3	C
G	2	E
H	3	F,G

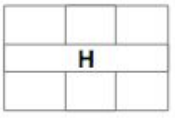
a) Complete the following Activity On Node (AON):

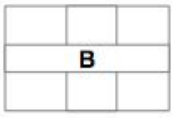


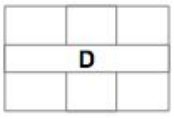


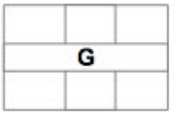












b) Identify the critical path(s) (please use the format: X->Y->Z, where X, Y and Z are hypothetical activities)

c) This project is going to take ___ days
(complete the sentence with the the exact figure).

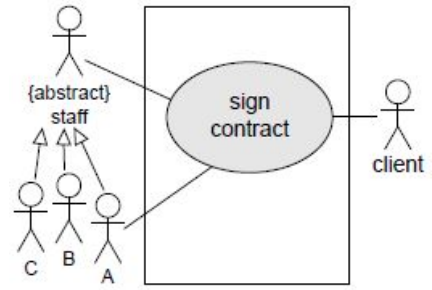
Part II - Use Cases and Scenarios (4)

2. How do you model the following situation with a UML 2 use case diagram:

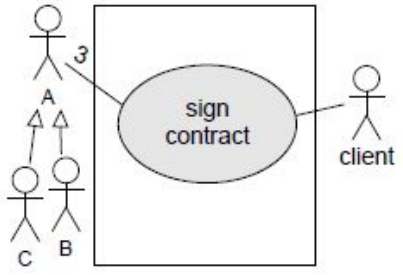
"*There are 3 different types of staff members namely A, B and C. For a valid contract, the client, one staff member of Type A and two other staff members of either type (A, B or C) have to sign the contract. The possible employee combinations are: AAA, AAB, AAC, ABB, ACC, ABC*"

(choose the most **correct answer**)

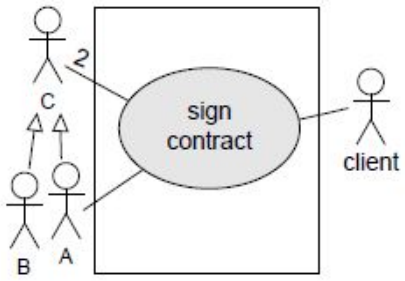
A



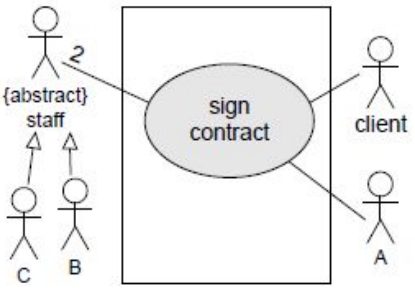
B



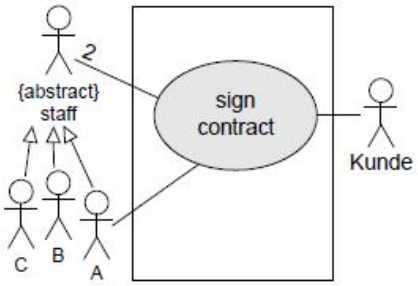
C



D



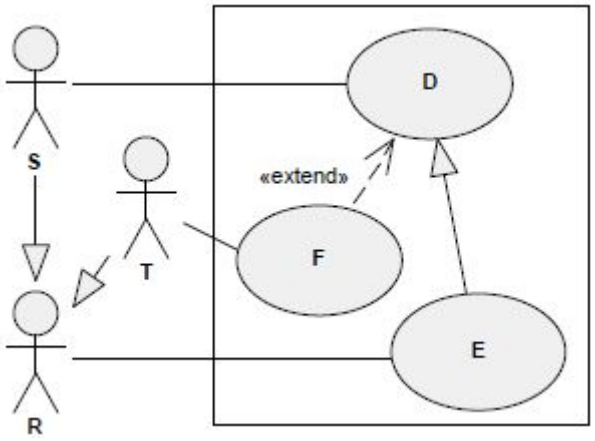
E



3. Actors in a use case diagram ...
(choose the **incorrect answer**)

A. ... can be linked to abstract and non-abstract use cases via associations.
B. ... might be used by the described system.
C. ... represent roles of the users of the described system.
D. ... are always located within the described system.
E. none of the above

4. The following Use Case Diagram was modeled according to the **UML2 standard**. Which combinations of actors communicate with Use Case E?



Select one or more:

A. R
B. S
C. T
D. R ∧ R
E. S ∧ S
F. T ∧ T
G. R ∧ S
H. T ∧ S
I. R ∧ T

5. Consider a beverage machine. If the actor is 'customer', and the scope is 'machine', what is the scenario (Option A, Option B, Option C or Option D, or none) more likely (and more correct) to be found in the main scenario of the use case 'get drink'? Put a circle in the selected one.

Name: Get Drink
Description: A customer gets a drink from the vending machine.
Main Actors: Customer
Secondary Actors: None
Pre-condition: None
Main Scenario:

Option A
1. The use case starts when the drink is chosen
2. If drink available then show price
3. Put in coins
4. If paid enough then deliver drink
5. The Use Case Ends

Option B
1. The use case starts when the customer chooses the drink
2. The machine shows price
3. The customer puts in coins
4. The machine delivers drink
5. The Use Case Ends

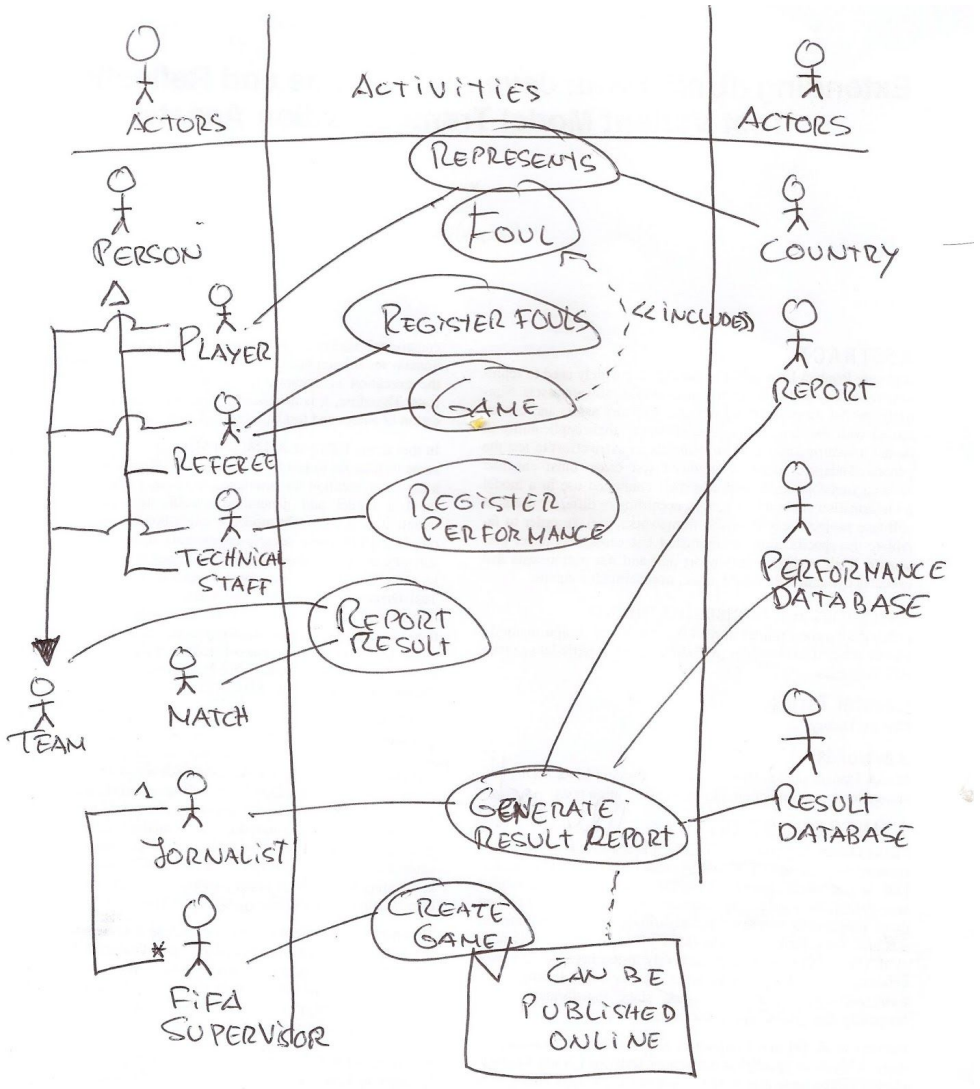
Option C
1. The use case starts when the drink is chosen
2. Shows price
3. Puts in coins
4. Delivers drink
5. The Use Case Ends

Option D
1. The use case starts when the machine sends the price to the LCD display
3. The customer put coins in slot
4. The coin mechanism verifies amount and tells machine controller
5. The machine controller activates boiler
6. The Use Case Ends

Option E
None

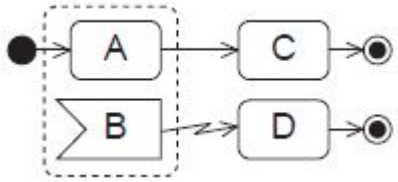
Alternative Scenarios: none
Post-conditions: none

6. Consider a system to manage the Football World Cup. The competition involves several games with teams of different countries. In each football match, the players and the technical staff represent their county. There should be in the beginning of each match a FIFA representative person who is responsible for creating the file of the game in the system. This person should also introduce the results of the game at its end. At the end of each game, one technical person of each team should register the performance details about the players. The referee should also register the fowls of the players. The systems should maintain an internal database of the performance and results, so that the journalist can generate the list of results whenever i tis necessary. Based on what described before, identify all the reasons why the diagram is incorrect. Mark in the picture the incorrections with a code label (e.g. A,B,C,...) and justify in detail each one of them in the next page.



Part III - Activity Diagrams (0.5 points)

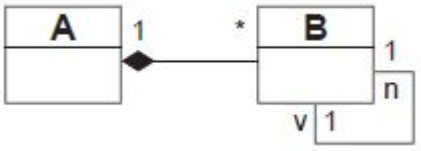
7. You are given the following activity diagram. Which (one or more) of the following action sequences are possible during one execution of the activity diagram?



A. A → C → B → D
B. A → B → C→ D
C. A → B → C
D. A → B → D → C
E. None of the above

Part IV - Class Diagrams (0.5 points)

8. You are given the following clipping of a UML2 class diagram. Which of the following statements are true?

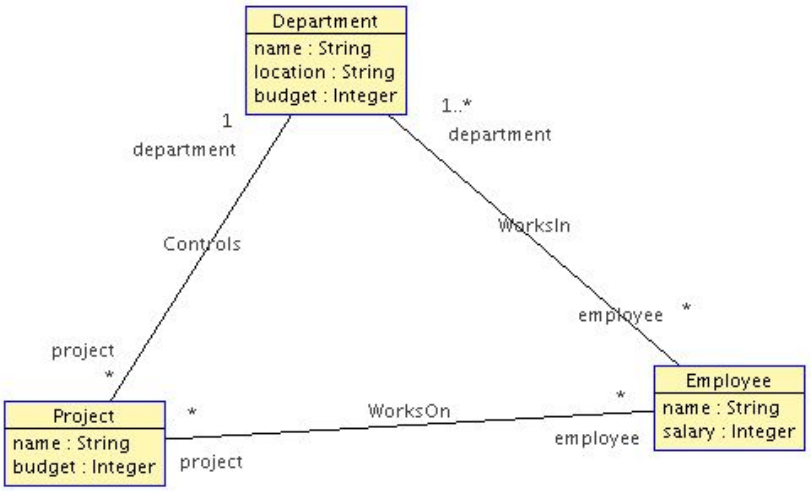


Select one or more:

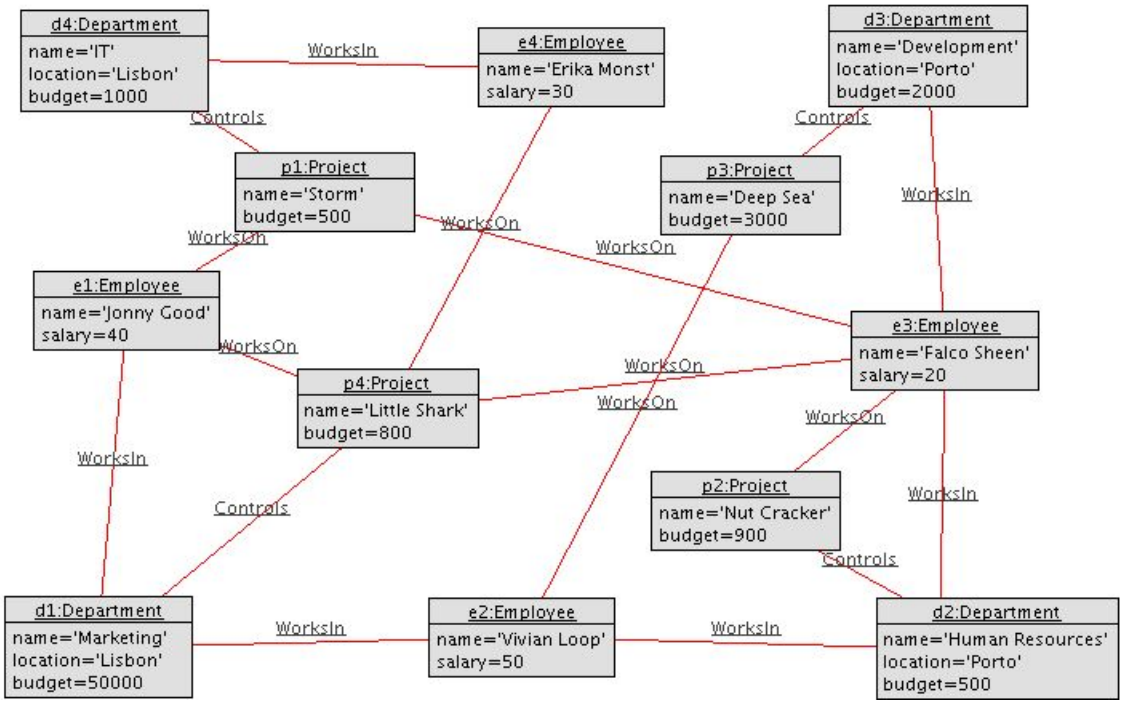
a. One object of A may be associated with one object of B.
b. If an instance of B is deleted, all contained instances of A are deleted as well.
c. The diamond near A is called composition.
d. one object of B is contained in exactly one object of A.
e. One object of B is associated with two other objects of B.

Part V - OCL (3 points)

Suppose that a System Analyst, after doing a domain analysis, designs the following class diagram related to a specific company:



Consider that we have the following object diagram (instances of conformant to the previous model):



Taking into consideration the previous diagrams:

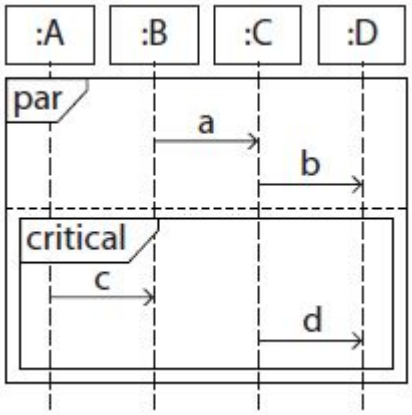
9. Given the following OCL expressions identify which one is true, in the context of the previous diagrams:

A. The result of evaluating “Bag{1,2,3,4,5}->iterate(number: Integer; sum:Integer = 0| sum+number)” is “15 : Integer”
B. The result of evaluating “OrderedSet{1,3,3,4,5,6}” is “OrderedSet{1,3,4,5,6} : OrderedSet(Integer)”
C. The result of evaluating “Bag{1,1,2,2,3,4,5,6}” is “Bag{1,3,3,4,5,6} : Bag(Integer)”
D. The result of evaluating “Sequence{1,1,2,2,3,4,5,6}” is “Sequence{1,1,2,2,3,4,5,6} : Sequence(Integer)”
E. None of the above

10. In the context of the previous diagram, Write OCL invariant rules that specify that If a given department has a budget greater than 3000, then it must have at least 3 projects with budget greater than 400 and must have a fully dedicated employee to that department (with no projects outside this department) with a salary greater than 100.

Part VI - Interaction/Sequence diagrams (0.5 points)

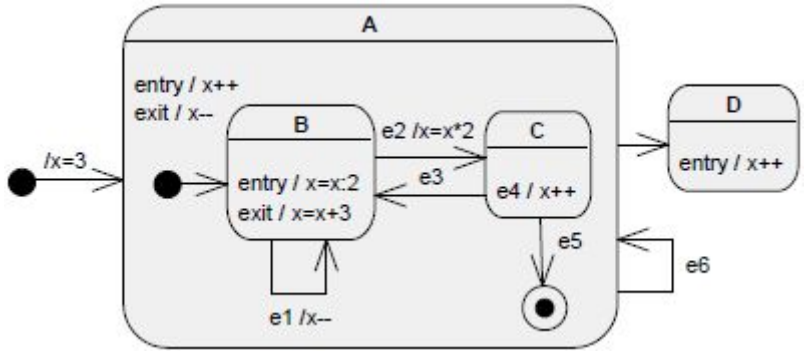
11. You are given the following sequence diagram. Which traces are possible?



A. a → b → c → d
B. a → b → d → c
C. a → c → d → b
D. d → c → a → b
E. c → a → b → d
F. d → a → b → c
G. a → c → b → d

Part VII - State Charts (3.5 points)

12. You are given the following state machine diagram. What is the value of x after the occurrence of the event chain: **e1 e2 e4 e4 e3 e1 e6**?



X=

13. Model the statechart representing the behaviour of a traffic light. Consider that the traffic light works in the following way:

- The traffic light has three lights: Green, Yellow and Red;
- The traffic light can be totally switched On or Off;
- When turned On, the Traffic light is green;
- In normal operation the traffic light makes transitions between colors (loop green->yellow->red, and then back to green) by waiting 20 seconds per light;
- The police and ambulances (recognized by the sensor device in the traffic light) turn the traffic light to intermittent yellow (switched on and off in cycles of 2 seconds);
- If necessary, for maintenance reasons or by decision of the police, the automatic mode of the traffic light can be interrupted and change to manual mode (a special button on the traffic light receives this information). In this case, the traffic light changes to Red, and then it keeps waiting until the button is pressed again to change to Green, and then the same to Yellow and followed by Red.
- A reset button brings the Traffic Light to automatic mode again to the light color it had before being set to manual mode.

Part VIII - Component Diagrams (3 points)

14. Design a component diagram which satisfies the specification below.

You are in charge of specifying a hotel management system, whose characteristics are depicted as follows. Firstly, a customer should be able to book a hotel, based on availability, through the internet. Check-ins and check-outs of guests should be done by the reception staff. During check-in, the receptionist should create a guest account and allocate a room for him (just consider individual rooms).
All guest spending are recorded in the system (e.g., dinner, drinks, lunches). The guest can consult the balance and transactions on his account during the hotel stay. The system should also allow the recording of complaints to be sent to the hotel management. During check-out, when the payment is being processed, if a late departure (after noon) is detected, a penalty must be calculated and applied.
The system must also support room maintenance activities. Maintenance personnel should record the beginning and end of the intervention in a particular room (not occupied by any guest), which becomes unavailable. Therefore, when new guests arrive the staff cannot allocate a room that is in maintenance.

Part IX - Deployment Diagrams (3 points)

15. Design the deployment diagram that models the following situation:

MyManager is an Information System on a given Company based on a Client/Server solution. The server component comprehends the ***"BD-MyManager"*** database that runs on the Oracle DBMS, that runs on a machine ***"IBM AS400"*** with ***"IBM AS 400i"*** operating System. On the other hand, the client component, which is a "fat-client", corresponds to a Windows application with two possible variants: ***"HIWinClient"***, that runs on PCs with ***"WindowsCE"*** installed and Mobile phones/Tablets running Android. Both kinds of clients access the database via the proprietary ***"HISQL"*** protocol. There can exist at most 20 PCs and 10 Tablets with the respective clients installed. The relevant interface for the "Human Resources" consists of a Java application, ***"HROutInterface.class"*** which is accessed via ***HTTP*** and is installed on the ***"IBM AS400"*** machine.